Space Weather Technical Forecast

Issued on Saturday 1 March 2025 at 12:51 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with occasional C-class flares. Peak flare was C6.4 at 01/0830 UTC from AR4010 in the northeast disc. There are six regions currently on the Earth-facing disc. The most notable of these are AR4007, just west of the south-centre disc and AR4009 in the northeast, although any growth within these regions appears to have stalled. AR4007 is a very small region, which has shown an unusual magnetic structure, with both its trailer and leader of positive polarity, with negative polarity intermediate spots. However, its leader spot has since faded, which may lead to a simplification of this region. AR4009 is magnetically simpler, maturing into a bipolar group, with no further growth observed. The other regions remain smaller and simpler.

No Earth directed CMEs occurred. A broad ejection to the west was determined to be from an eruption just over the northwest limb, while the C5.2 flare from AR4006 produced a CME that will pass well to the north of Earth.

Solar Wind / Geomagnetic Activity: Solar winds are indicative of a connection to a strong positive coronal hole fast wind (CH19/+). Solar wind speeds have been at Strong levels, between 630 and 770km/s, gradually easing a little back to near 700km/s. Density was around or below average. Interplanetary Magnetic Field, Bt, eased from Moderate, at 11nT, to be Weak at around 5nT. The north-south component, Bz, was Moderate at first, between +9/-9nT, but tended to be Weak and predominately positive (northward) from 28/1530 UTC. Phi angle was positive (away from the Sun). Geomagnetic activity was mostly Unsettled to Active (Kp3-4) during the period.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 eased to be at background, after recent enhancements. High energy electron flux was Background to Moderate. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), recording 8.5e6 integrated pfu at 01/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low to Moderate with an ongoing chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There was a chance of a glancing CME impact early on 01 Mar, from the filament eruption off the east disc on 26 Feb, although this looks to have missed

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Earth. Otherwise ongoing fast wind influence from CH19/+ at first is expected to gradually ease, with Strong winds gradually and erratically easing to Background. Geomagnetic activity will be mostly Unsettled to Active on Day 1 (01 Mar), becoming mainly Quiet to Unsettled by Day 3 (03 Mar).

Energetic Particles / Solar Radiation: High energy proton flux is likely to be at background levels. There remains a slight but declining chance of further enhancements, should any larger flares occur from AR3998 around the west limb. High energy electron flux is likely to increase during this period. The associated 24 hour fluence also has the potential to rise, with a chance of breaching the Active (1e8 integrated pfu) threshold by Day 3 (03 Mar).

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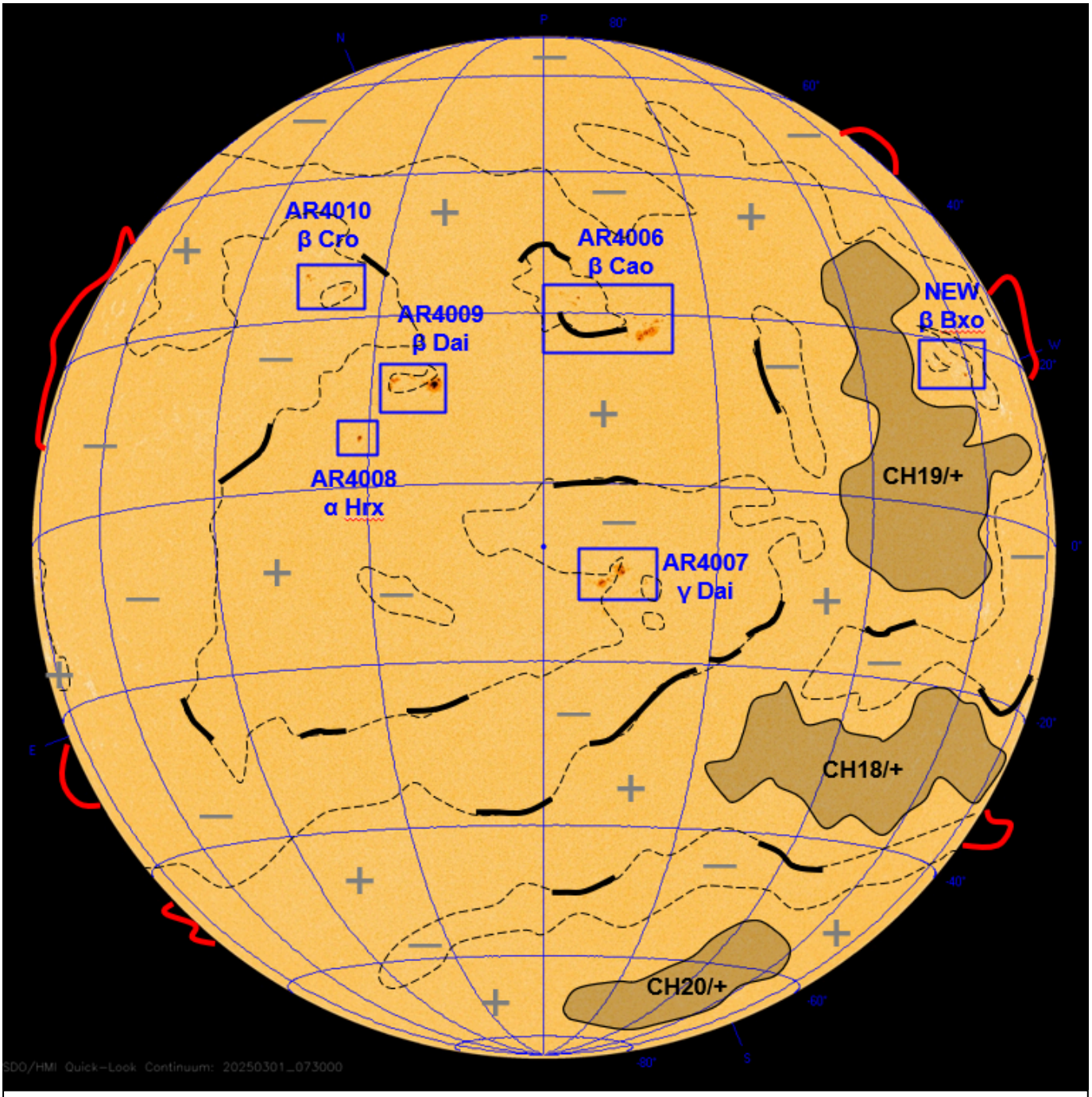
Figure 1: MOSWOC solar analysis map - valid 01/0730UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There was one CME in the forecast, which was anticipated to pass close to Earth early on day 1 (01 Mar), although is now considered to have passed. However, there was a slight enhancement observed at Solar Orbiter around 28/1200 UTC. While better located to observed this CME, at 15 E compared to Earth at 0E, this suggests any potential glance would have likely occurred early day 1 (01 Mar). The other CMEs, including the C3.6 flare of AR3998 on 25 Feb, and a filament eruption from centre disc on 26 Feb, are not expected to be observed at Earth.

Otherwise, current fast winds are expected to gradually ease from later on day 1 (01 Mar) back towards background by the end of the period. There are no other enhancements currently expected through the period.

Geomagnetic activity is likely to be Unsettled to Active on day 1 (01 Mar), with a very slight chance of G1/Minor Storm, if any prolonged negative Bz occurs. Becoming mostly Quiet with Unsettled intervals by day 3 (03 Mar).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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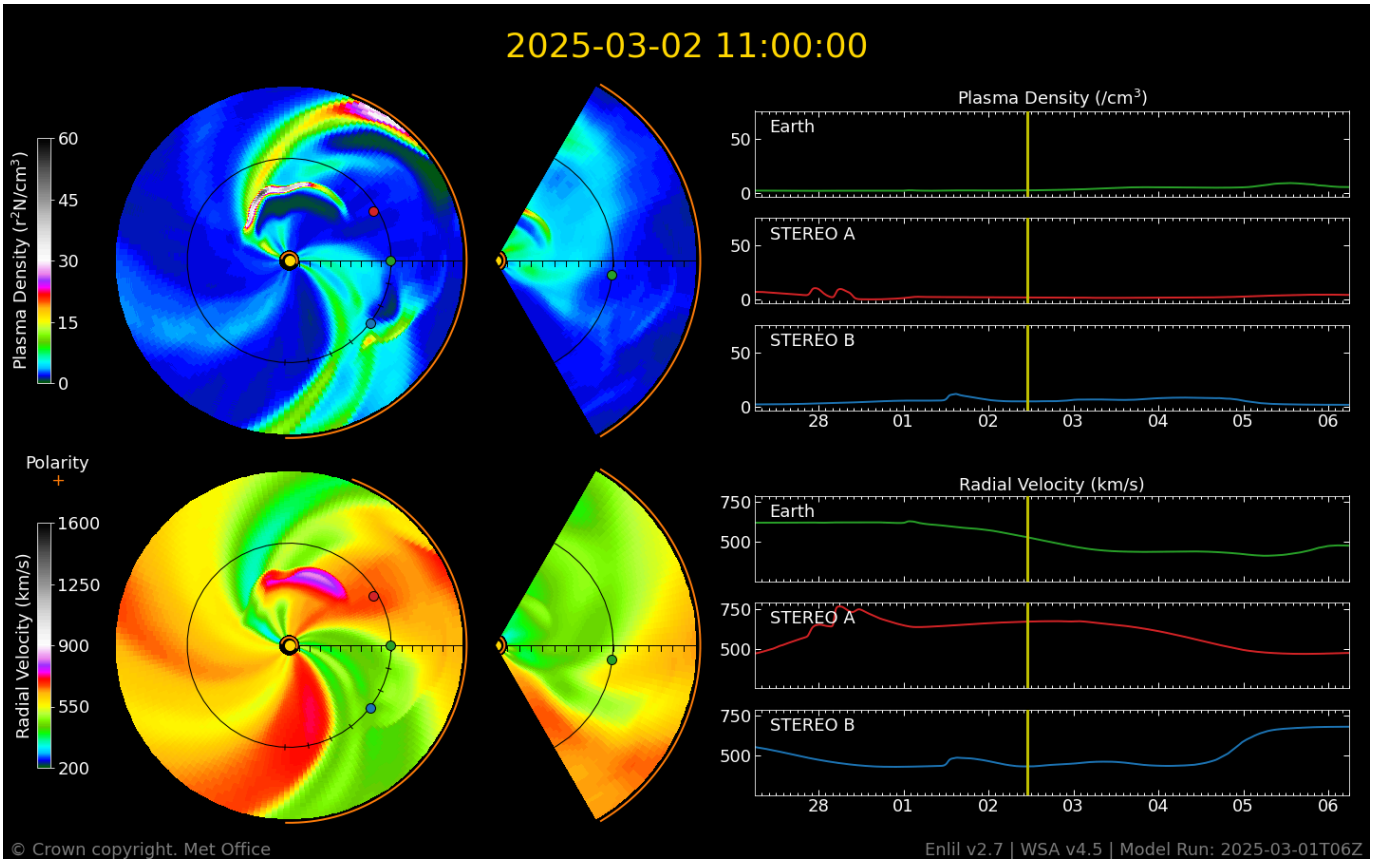
Figure 2: MOSWOC Enlil showing easing CH fast winds.



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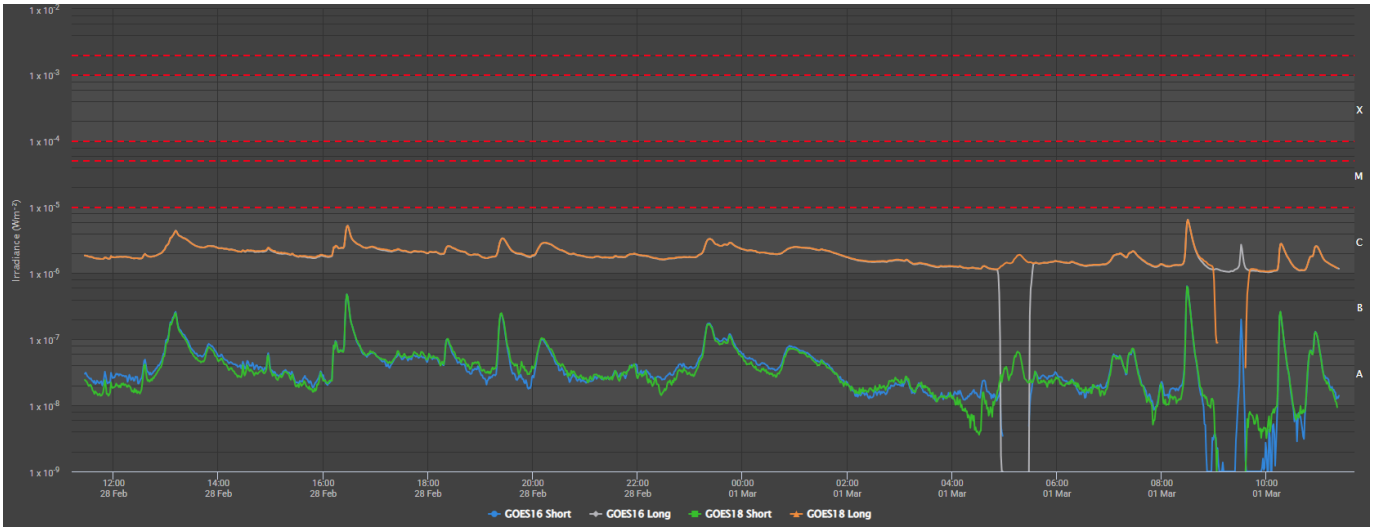
Radio Blackouts - X-Ray Flares

Low to Moderate activity is forecast with a chance of isolated M-class flares.

There are currently six regions on the visible disc. AR4007 is noteworthy, due to its unusual gamma Mount Wilson structure, with both the leader and trailer positive polarity, and a collection of negative polarity intermediate spots. Although the leader spot is showing sign of decay, so this structure may be in the process of simplifying. Despite also seeing rapid development, AR4009 has a more typical bipolar structure, and has matured into a more open group. AR4006, while continuing to decline, also remains of interest due to it including a nearby filament, increasing the flare potential of this region.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	40	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: GOES16-18 X-Ray Flux trace.



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Solar Radiation Storms (High Energy Protons)

GOES-18 high energy (>10MeV) proton flux is at background, and expected to remain at this level. There is a slight chance of enhancement given any significant eruption from the sunspot regions currently on the Earth-facing disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

The high energy electron flux (>2MeV), as observed at GOES-16, has risen from Background to give a period of Moderate flux. This was due to the recent charging of the outer Van Allen Belt from the fast wind enhancement from CH18/+. Subsequently, this rising trend is expected to continue through the period, as the Strong solar winds, and the peak electron flux through the Belt expands outwards towards GEO. Persistently Moderate is likely to develop with periods of High, and perhaps becoming persistently High by day 3 (03 Mar).

The associated 24 hour fluence is expected to see a rising trend, likely rising above the Active level by the end of day 3 or day 4 (03-04 Mar). This rising trend is supported by MOSWOC REFM, although this potentially too quick with the likely enhancement, and overestimating the likely value.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	5	20	60	50
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: GOES 16>2MeV electron flux.

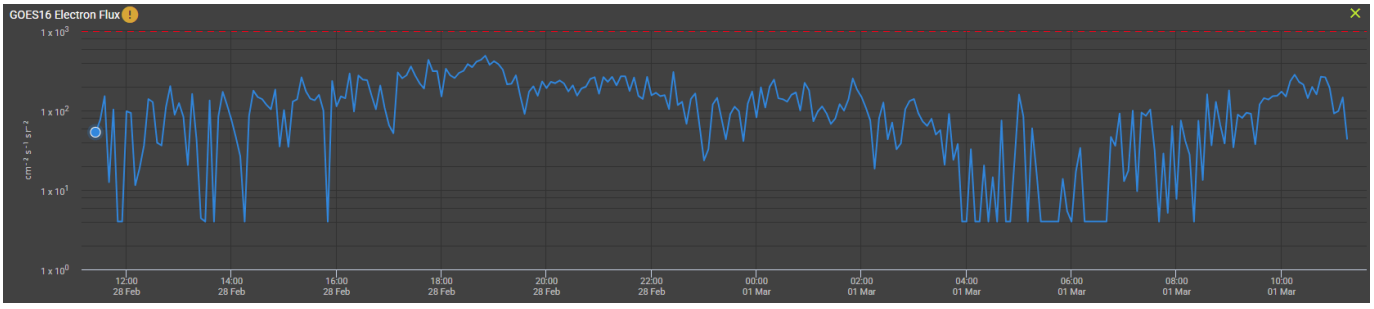

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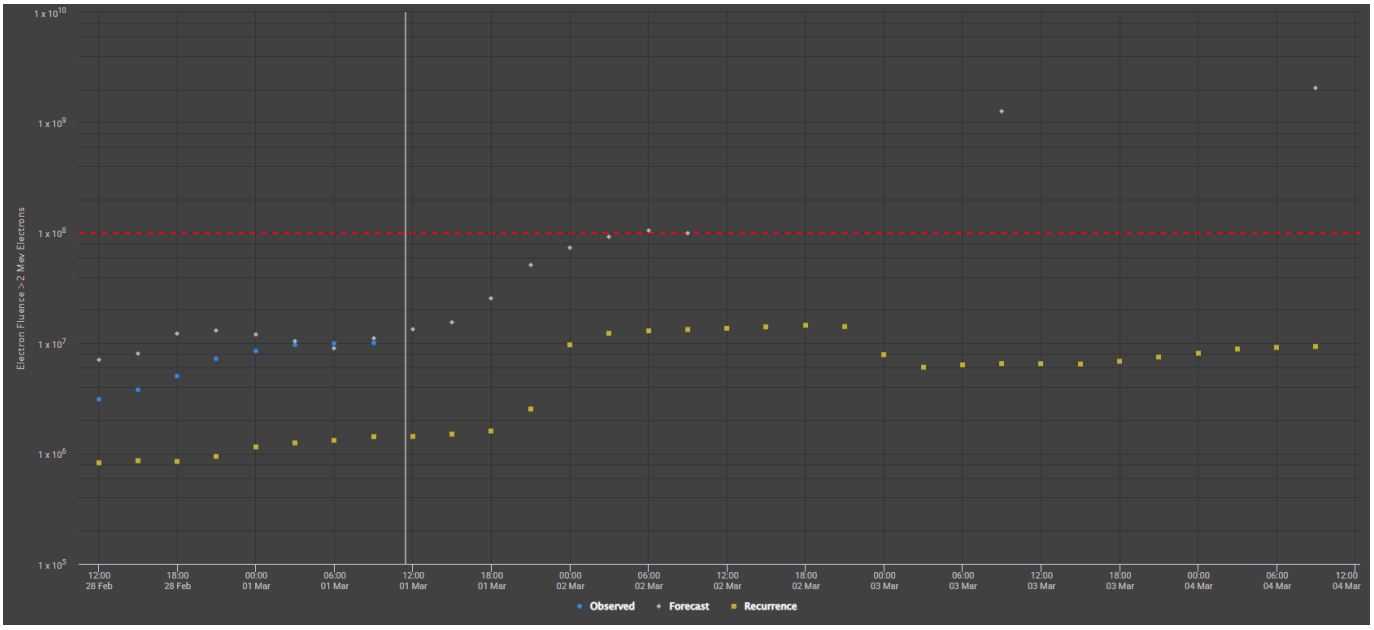
Figure 5: MOSWOC 24 hr electron fluence with REFM forecast.



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